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ABSTRACT

Pointing out the difficulties in passing from the industrial age to the information age, this paper discusses the advent of new technologies and worldwide recognition of the significant influence technology will have for education. Conferences resulting in development actions aimed at introducing new information technologies into education and exploring the educational systems of other countries are discussed. Major changes for education are identified as raising graduation requirements, using various technologies for more effective instruction, and delivery of education outside classrooms. Technological developments will also affect competition in the private sector and high technology jobs will become more common. Government programs designed to assist educators in joining the technology revolution are briefly described, including: Projects BEST, SLATE, and VIM, which provide training in the uses of technology in education; block grant funding to aid educators to move into a new age; and supporting developmental projects using technology in education to become models for other school districts. These projects include "lighthouse schools" identified by the National Diffusion Network, which use technology for remedial programs in math and science, more efficient recordkeeping, and alternative occupational education; a series of school-based technology projects for achieving educational objectives in basic skills; the Computer Learning Center in Houston, which is developing school technology-based curriculum for secondary students; publication of survey results on computer literacy; and the establishment of a School Technology Center at Harvard University to conduct research. Recent examples of meetings in various areas of education are reported. (DJR)

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"Trends in New Information Technology"

by
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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

It is great to be back in the State of Texas and have the opportunity to address such a distinguished group of educators on the topic "Trends in New Information Technology".

This is my fourth trip to the great state of Texas this year. This state has gained national recognition not only for its comprehensive focus on improving education through the work of your statewide commission but also for its leadership in the technology revolution which not only is sweeping our country but the world as well.

Texas gained a great prominence in our economy by its production of our great natural resource energy--oil and gas; Texas is also on the cutting edge of the development of high tech industries with a premium on the processing of sophisticated equipment and rapid information.

We are passing from the industrial age to the information age. The change is becoming so rapid, so thorough, so complete that it is difficult to keep up with all the developments. We are part of a rapid global development, and unless we become a part of it we will find that it will sweep by us leaving us in its wake. We do not have the luxury of looking at this movement and using the words of that hit play of not too long ago: 'Stop the World, I Want to Get Off.'

In his perceptive book Megatrends: Ten New Directions Transforming Our Lives, John Naisbitt tells us that the information age is a reality and attributes the launching by Russia of Sputnik in 1957 as the beginning of the globalization of the information age. Thus, he notes:

> The real importance of Sputnik is not that it began the space age, but that it introduced the era of global satellite communications. (p 12).

He adds that the space shuttle Columbia in 1981 greatly aided this move since space shuttles can launch larger satellites that incorporate ground station functions and ground stations will fit on the rooftops of houses.

So despite the great accomplishments of Sputnik and Columbia in opening the heavens, Naisbitt stresses these satellites helped the transformation to the global village by which the satellite era turned the globe inward upon itself. We are all aware of the great accomplishments and central focus of Texas in the development of the space frontier.

I mentioned a moment ago that Texas has great resources in the field of energy. During our malaise of the late 1970s there was a great focus on us running out of natural resources such as oil. These natural resources help to fuel our industrial age. During the information age we will be mass producing information as we mass produce automobiles. And Naisbitt notes that the information society gives us for the first time an economy based on a key resource which is not only renewable but self-generating. Our problem will not be getting enough of it but the problem of drowning in it; we face the threat of drowning in information while being starved for knowledge. Texas is at the heart of that information society development.

And what does this offer for the future? The late Dr. Herman Kahn, the futurist who was affiliated with the Hudson Institute, offered a startling conclusion in his last book The Coming Boom. He predicted high and sustained growth for the U.S. economy in the 1980s and 1990s because of a whole host of new technologies and technological innovations ready for large scale development.

We are on the threshold of many new and great developments.

The vacuum tube has been replaced by the microchip.

Room size computers have been replaced by desk top computers or computers which can be carried in brief cases.

Robots have been successfully introduced to handle routine factory jobs or assembly line productions or positions on a urban area's police bomb squad.

Look at the magazine racks in your local drug store or the book table in your local book store. You could probably count on one hand the number of magazines and books available on computers a few years ago. Presently you will find a whole section or table of computer related publications--so many that it is almost impossible to keep up with the plethora of publications.

This "information age" has a significant influence for education but it is a significance which is being recognized world wide.

Just last week, almost two hundred delegates assembled in Paris, France for a special project of the Centre for Research and Innovation of the Organization for Economic Cooperation and Development (OECD). The meeting, including the 24 nations of OECD (the United States, Canada, France, West Germany, Denmark, Australia, New Zealand and Japan among them) focused on a project entitled the "New Information Technologies." I had the privilege of serving as head of the eight person United States delegation. One of the conclusions of the study leading to that conference was that by early 1983 virtually all the OECD countries had engaged in policy and development actions aiming at introducing the new information technologies into education. While the specific forms for introducing the new information technologies varied from country to country, the movement was strong in the majority to continue along the introduction.

One interesting aspect came through the documents prepared for the New Information Technologies conference. In the 1970s the forces underlying the technological demands for education were essentially educational. Yet in the decade since, a qualitative change has take place. These pressures for technological change are coming from factors outside of education. These pressures have come from restructing of a nation's economy especially from the influences of technology, the penetration of technologies in all spheres of society, the evolution of the education technologies themselves (especially the increased specialization and the reduction in price and size), the concern with education and the labor market (particularly the impact on youth unemployment) and focus on political concerns in a technological world such as international trade questions.

All of these factors have brought a continuing concern to OECD countries to focus on information technologies.

During the same week as the OECD conference, U.S. and Japanese educators met in Washington, D.C. as part of CULCON, a U.S.-Japan dialogue on education and culture with a focus on exploring each others educational system. (I might recommend to you a very enlightening article on "Education in Japan '84" which appeared in the June 14, 1984 issue of Far Eastern Economic Review). A recent report noted that U.S. children were behind their counterparts in Japan and the Republic of China on Taiwan even before they begin school.

It is certainly no secret that despite current debate and discussions in Japan over its educational system that Japan is doing an impressive job and is doing a commendable job in the microcomputer industry. We Americans know what

happened to our own automobile industry and television industry as a result of the competitiveness and ingenuity of the Japanese; we are now competing with them in the microcomputer industry.

We are also aware from various reports of the fifth generation computer, a new breed of supercomputers so fast that they can surpass today's machines a thousand times over and can outthink humans. In a program comparable to the U.S. space program, Japan has pledged its efforts within a decade to develop and market a fifth generation of computers--artificial intelligence machines which can reason, draw conclusions, make judgments and even understand the written and spoken word.

In an information age where knowledge is power and will be power, we cannot afford to be apathetic. Knowledge is power and the computer is a manifestation, an amplifier of that power. Experts Edward A. Feigenbaum and Pamela McCorduck (The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World) discuss a second computer age. They note:

> We view it as the important computer revolution; the transition from information processing to knowledge processing, from computers that calculate and store data to computers that reason and inform. Artificial intelligence is emerging from the laboratory and is beginning to take its place in human affairs. (p.1).

These educators observe that the American computer industry has been innovative, vital and successful and has created value by transforming the brain power of the knowledge workers. The U.S. presently dominates the world ideas and markets in this most important of all modern technologies. Yet, they also raise the provocative question: What about tomorrow?

What is the meaning of these developments for all of us as educators?

It provides challenges and dilemmas for us. Let me sum up what I see as the major significance of these changes.

1. We have serious problems with our U.S. educational system which were succinctly dealt with by the report of the National Commission on Excellence in Education entitled A Nation at Risk: The Imperative for Educational Reform and numerous subsequent reports. Social promotion, an overemphasis on equity at the expense of academic excellence, a watering down of academic requirements and course contents, and the promotion of life style courses over the substantial ones such as math, science and history, have left our present educational system in grave difficulty.

The recent report issued by the U.S. Education Department The Nation Responds: Recent Efforts to Improve Education does show great advances during the past year. For example, forty-five states have proposed or adopted curriculum changes and forty-eight states have proposals or raised graduation requirements. We need to keep up the momentum but we still have a long way to go.

2. Educational technology offers us the opportunity to enhance student learning, increase teacher productivity, and develop more effective schools.

Our classrooms, however, must not become large videogame parlors; we must continue to link the use of technology with improved quality and productivity in education. We must explore how we can combine the various technologies--computers, videodiscs, cable television--to more effectively deliver an education product.

3. New information technology provides new ways for us to deliver education outside classroom. This can better aid us in the goal identified by the National Commission on Excellence in Education: the creation of a lifelong learning society.

4. More rapid changes in the economy will require more and recurrent education.

5. There will be increased competition by the private sector using the new information technology to meet educational needs.

6. There is a vast new job future relating to the information age. In 1980, according to Business Week magazine, there was one electronic work station for every 23 white collar employee in the economy while by 1989 there will be one electronic work station for every two white collar employees. Job titles such as data base specialist, systems analyst, systems/programming/ manager will become more and more common.

When the Secretary of Education T. H. Bell announced a Technology Initiative for the U.S. Education Department, he designated the Office of Educational Research and Improvement as the lead office in that initiative. During the past two years we have made progress in assisting State and local educators in joining the "technological revolution" which is sweeping all fields. We in education cannot afford to be left behind.

Notably OERI through Projects BEST, SLATE and VIM has trained thousands of educators, education leaders, and opinion makers in the uses and potential uses of technology in education. The tapes from these training sessions are available and in use for training other educators. We provided the essential tools needed for State and local educators to become knowledgeable on instructional technology, establish contact with one another (now continuing through electronic mail) and explore the advantages and disadvantages of using technology in the classrooms; we in turn have left the decision-making on how to use and when to use and if to use technology in a school system up to the State and local educators.

We have avoided--and I believe it has been a wise decision--endorsing or supporting a expansive and expensive federal program to purchase hardware and/or software for schools. The memories are still too clear and painful of the massive amounts of federal money which went into media materials in the 1960s and 1970s--much of which was not used effectively or gathered dust in school closets.

However, the President and Secretary of Education did support legislation which eventually resulted in consolidating almost thirty federal categorical aid programs into a block grant proposal (Education Consolidation and Improvement Act) where State and local officials have the option to make their decisions on how to use these funds to meet their own special needs and priorities. We have been pleased that these block grant funds have been a source of funding for State and local school districts to purchase hardware, software and other media materials appropriate to their needs or, more appropriately, to join the "technology revolution" without federal dictation or intrusion. Combined with the training and practical experience involved with Project BEST, SLATE and VIM, the availability of block grant funds have aided State and local educators to move prudently into a new age of educational challenges where they possess the knowledge and decision-making authority to move wisely and effectively.

There is also another federal leadership role beyond the training and availability of funds; this role has been to identify outstanding uses of technology in education--locally developed--and provide support for these projects so they can become working models for dissemination and replication throughout the country.

We have identified ten "lighthouse schools" through the National Diffusion Network--outstanding models of schools using technology for remedial programs in math and science (Project HOSTS), for more efficient recordkeeping (Hopkins, Minnesota project) and for providing an alternative occupational program (Project COFFEE). Funds have been provided to bring educators to visit these projects and to instruct them in how to implement similar projects in their own school districts. If a safe policy maxim is "if its not broke, don't fix it," a better one is "Let's not re-invent the wheel." If a technology program has been successful in the "lighthouse schools", other school districts should have the opportunity to examine it and then make their own decisions whether they wish to adopt the program.

Notably, through the leadership of Secretary Bell and aid from his Discretionary Fund, OERI assisted (through the Center for Libraries and Education Improvement) in providing $1.5 million in assistance to 12 school-based technology projects. Educators were challenged to identify an educational objective in math, science, reading or writing and submit a proposal of how one or more of the new technologies could be used to achieve that objective. These are direct grants from the U.S. Education Department to ongoing projects developed and implemented at the school level. One of those projects is with the Houston Independent School District. These are projects on the cutting edge of technology. We expect these to be supported for two years with case histories written. Even in the six months or so of support for these projects, we have been amazed by the development and creativity of these projects. These projects could well be one of our "finest

hours" in assistance to technology project. The expertise and leadership in our Center for Libraries and Education Improvement has greatly aided the advance of these projects.

The Houston project represents one of our most exciting ventures. It is called the Computer Learning Center, Module Development Project. The purpose of this project is to develop a technology-based curriculum for secondary students that will be correlated with the computer literacy program already in place in the Houston Independent School District. Organized in four strands--Basic Skills, Computers as Tools, Computers in Society, and Future Trends--appropriate instructional activities will be applied to each strand in order to focus on the development of the student's higher-level thinking skills.

Within OERI, our National Center for Education Statistics has conducted surveys on the number of computers in our schools, and convened a panel on defining and analyzing computer literacy. The result has been a useful publication Computer Literacy: Definitions and Survey Items for Assessment in Schools.

The National Institute of Education is supporting research on the application of computers in schools. They have established a School Technology Center at Harvard University.

Conferences and meetings of those with expertise and interest in various areas of educational endeavor can contribute in a very positive way to the enhancement of education. There are some recent examples of such meetings which have been held under the sponsorship of OERI:

1. In Pittsburgh under the auspices of the University of Pittsburgh and Carnegie-Mellon University was a conference which focused on the uses of computers in education, and what research is needed in order to realize the potential of the computer in educational practice. The forty participants consisted of representatives from the fields of: computer science, psychology, educational research, teaching, and school administration, as well as parents. Their report, Computers in Education: Realizing the Potential, provides a valuable resource to those investigating the uses, and possible uses, of computers in education.

2. In December of 1984 in Madison, Wisconsin at the University of Wisconsin, forty-four participants from a cross-section of society--mathematicians, mathematics educators, textbook writers and publishers, test developers, and mathematics state-wide supervisors--met to discuss and explore, issues in the area of mathematics education. The result of their efforts, School Mathematics: Options for the 1990s, is due to be published this summer.

3. As a result of the report of the National Commission on Excellence in Education, a series of seminars were held to explore the role of libraries in the "Learning Society." All types of libraries were represented--university, community, school. The role of libraries in a technological age was explored in-depth. The publication from these efforts, Alliance for Excellence: Librarians Response To A Nation At Risk will be released this month.

As you can see, there is a high-degree of activity going on in all facets of educational endeavor. We all have reason to be excited about the changes and advancements which are taking place. I think we can look forward to very positive results.

All of you gathered here can play a vital role in this next stage of development for technology and education. As John Naisbitt writes in his final statement in Megatrends: "My God, what a fantastic time to be alive!"